



Energy
Efficient
Mortgages
Initiative

Support Actions and Regulatory Instruments, an overview among selected European Countries

Version: 23/12/2022

Main author: Monica Billio, Carlotta Gianni, Iva Hristova, Toby Tucker

Dissemination level: Public

Lead contractor: UNIVE

Due date: 31/01/2022



EeMMIP projects have received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 894117 respectively.

Table of Contents

1. Introduction.....	5
2. Differences among EE policies.....	7
2.1 Description and main differences between support actions and regulatory instruments, country distribution	7
2.1.1 Definition and main differences	7
2.1.2 Country distribution	9
2.2 Focus on financial and fiscal tools	11
2.2.1 Definition and main differences	11
2.2.2 Country distribution	11
3. Survey	14
3.1 Aim and objective of the survey	14
3.2 Results on the use of energy efficiency policies.....	15
3.2.1 Different use in sectors, types and topics	15
3.2.2 Use of EPCs in the offer of financial products	17
4. Case Studies.....	20
4.1 Superbonus 110% (Support Action, Italy)	20
4.2 KfW programme (Support Action, Germany)	23
5. Conclusion	27
References	28

Executive Summary

This deliverable was produced as part of Work Package 7 "Institutional Coordination", to provide an overview of existing EU energy efficiency legislation, which can be separated into two major groups of tools: supporting actions and regulatory policies. The analysis focuses mainly on support actions policies (including predominantly financial and fiscal policies) and aims to determine potential gaps in the legislation and local enforcement that, if overcome, could support market development. The report is divided into three parts.

In the first part, we introduce the importance and role of energy efficiency policies, especially how these policies have developed in the EU and how they contribute to energy conservation. The analysis then concentrates on the different types of measures used, support actions and regulatory instruments and their peculiarities. It is specifically detailed with references and demonstrates the variations between the two methods and the results they are capable to generate. As a result, supportive instruments are rather market oriented tools aiming to provide economic incentives allowing to promote positive actions, whereas regulatory instruments focus on achieving specific objectives. Further, the analysis shows how the various countries in the data set implement their respective policies. It is noteworthy to stress that while the adopted strategies at the EU level are quite balanced, there are significant variations among individual nations. Germany, Spain and France have the highest number of policies and show a majority of regulatory instruments in absolute terms. In relative terms, the Czech Republic, Poland and the Netherlands have the highest support policies compared to regulatory ones.

Furthermore, we proceed to a more in-depth distinction between fiscal and financial policies since they both constitute supporting actions. After a brief description of the specificities of this group, we propose an evaluation of their repartition among EU members. The observed findings reveal a notable variation in the application of the two types of policies. The most outstanding information is the majority of financial tools (90%) over fiscal ones; furthermore, Germany, Spain and the Czech Republic have the highest concentration of supportive action. In terms of fiscal policies, Italy, Sweden, and France have the highest concentrations. While these countries have the majority of fiscal tools, they are still in the minority compared to financial policies.

In the second part of the report, we adopt rather a qualitative approach in the study of energy efficiency policies. For this purpose, we elaborated a survey, completed by a pool of 43 experts belonging to the lending institutions participating to the EEM initiative. The aim of the questionnaire is to evaluate not only the degree of awareness of financial institutions with regards to the implemented EE policies in their respective countries, but also the degree of adaptation of their financial products to the specific regulation. Thus, the survey is structured first to determine the experts' knowledge on energy policies in general, but also their use. Namely, it tests the preferences among the different policy types (support actions or regulatory instruments), and sectors (residential, non-residential or both). Unsurprisingly, the surveyed sample is aware of at least some of the policies on energy efficiency. Residential and non-residential sector and supportive policies are also shown to be preferred. Furthermore, the study focuses on EPCs (Energy Performance Certificates), one of the main EE pillars, allowing to certify and monitor buildings' energy use. The entry into force of the Energy Performance of Buildings Directive (EPBD) required the application of EPC labels to all residential properties that are for sale or for rental (European Union, 2010). The transposition of this directive to the national regulation framework was under the responsibility of each member state which led to a highly diverse interpretation and contributed to complex national-specific EPCs structures that are difficultly comparable. On the basis of our survey, however, we can proceed to a limited comparison (in the countries under review) of the use of EPCs among lending institutions' products. While the majority of institutions offer energy efficiency products through EPCs, there is a minority that offers the same products internationally.

Finally, the report concludes its analysis of energy efficiency policies by specifically reporting two case studies of national support actions: the Superbonus 110% in Italy and the KfW program in Germany. The report strives

to provide a more detailed and precise understanding of Europe's current energy network through two recent examples in European territory. The Italian support action incentive enacted in 2020 presents important insights and gives room for several reflections; in general, there was a high demand for obtaining the benefits of the Superbonus 110% and in two years there were 338,950 applications. Among these, just 28,7 % did not complete all the stages of implementation, mainly due to the complex bureaucratic process. Different are the achievements and considerations of the KfW program. A notable aspect of the German initiative program is its size, scope, longevity, and focus on deep renovations; at the same time, it is critical that retrofits should not only be applied to private homes but also to public facilities.

1. Introduction

Since the Rio Conference in 1992 and the establishment of the United Nations Framework Convention on Climate Change, the international community has placed a significant emphasis on greenhouse gas (GHG) emissions mitigation. Fossil fuels' energy production and consumption play a considerable role in this paradigm due to their contribution to atmospheric GHG emissions. Despite global efforts for reducing energy demand and the inherent emissions, there is still a growing need for energy (M. Economidou et al., 2020). The Global Pandemic crisis and the current energy crisis related to the Ukrainian war have highlighted the complex economic and geopolitical mechanisms influencing the global energy demand, supply trends and the uncertainties that can affect both of them. Nevertheless, the projections provided by Coma et al. (2019) for 2050 concerning the world population increase (41%), the households' energy-dependency (115%), and the growing floor area per person (50%), clearly suggest a growing energy demand for the upcoming decades.

In industrialized countries, as in Europe, the residential sector is crucial to reduce energy demand. Due to their current contributions of around 40% of the EU's final energy and 36% of its CO₂ emissions, buildings have a significant untapped potential for energy savings¹(Hypostat, 2021). Due to obsolete building techniques, the usage of inefficient systems or appliances, and a lack of efficient technological control systems, a large portion of the energy utilized in buildings today is wasted. According to the most recent study by Hypostat (2021), almost 35% of European buildings are older than 50 years, and 75% of the total building stock is inefficient.

The European Union's efforts to make energy more efficient and sustainable began in the aftermath of the oil crisis, in 1970, as explained by the work of Economidou et al. (2020), and the first step from a legislative point of view was taken through the SAVE directive in 1992, the directive introduced policies, renewed recently in 2018, that led to major improvements in the building sector.

Moreover, the EU, through the Energy performance of buildings directive (2018), lists efficient energy use as one of its top priorities. The EU states that the building sector is essential for reaching the EU's energy and environmental goals based on the most recent data. More energy-efficient structures should impact positively the residents' living standards, reduce energy poverty and boost the economy through creating green jobs. With the aim to improve the energy performance of buildings, the EU has established a legislative framework that includes the Energy Performance of Buildings Directive 2010/31/EU and the Energy Efficiency Directive 2012/27/EU.

Together, the directives promote policies that will help:

- achieve a highly energy-efficient and decarbonised building stock by 2050
- create a stable environment for investment decisions
- enable consumers and businesses to make more informed choices to save energy and money

Both directives were amended in 2018 and 2019 to comply with the European Green Deal goal of decarbonizing the energy system by increasing energy conservation to reduce greenhouse gas emissions. Furthermore, in 2020, the Commission presented its Renovation wave strategy, as part of the European Green Deal. It contains an action plan with concrete regulatory, financing and enabling measures to boost

¹ An EEA study (2022) analyzed the same dataset to determine the primary sources of GHG emissions. Partly derive from the direct use of fossil combustion, specifically, oil and gas used in boilers for heating; another comes from the production of electricity and heat from the use of electricity consumed by water heaters, lighting, electrical devices, cooling systems, etc.

building renovation. Its objective is to at least double the annual energy renovation rate of buildings by 2030 and to foster deep renovation (COM 662 final, 2020).

The BPIE (2020) analyzed the Commission's proposal in depth, and here are the key features and innovations. The Renovation Wave will prioritize three areas:

- decarbonization of heating and cooling;
- combating poverty and energy inefficiency;
- renovation of public buildings such as schools, hospitals and offices.

The Commission proposes to remove existing obstacles along the renovation chain-from project design to project financing to completion-with a range of policy measures, financing instruments, and technical assistance devices.

A proposal by the European Commission to reform the Energy Performance of Buildings Directive was announced on December 15, 2021. It proposes changing national building renovation programs and requiring new construction to calculate lifecycle emissions. New energy performance criteria will be developed for decarbonising the building sector as part of the updated Energy Performance of Buildings Directive. Additionally, member states are required to ensure that residential buildings are at least class F by 2027 and class E by 2030, residential buildings meeting class F by 2030 and class E by 2033². New buildings must be zero-emission by 2030, and public buildings must be by 2027 (Updating the Energy Performance of Buildings Directive, 2022).

Community action and cohesion among countries in the European Union are critical to achieving efficient results. The IEA (2022) analysis notes that existing efficiency policy frameworks could serve as a springboard for swift action, especially given the high percentage of European buildings that are obsolete and need to be improved. Although, despite the directives from the Commission, member states situation is fragmented and highly varied.³

The current study takes the opportunity to give an overview of energy efficiency policies in the European context. First, different types of energy efficiency policies will be defined and explained. Once specified, we analyze how each type is distributed among 17 member states, illustrating how these differences characterize the situations in the different countries. In particular, section 2.1.1 defines in detail the differences between support action and regulatory instruments. It explains their strengths and weaknesses in the context of energy efficiency policies. Section 2.1.2 analyses supportive and regulatory policy distribution among the 17 member states selected. The different varieties of supportive instruments and how they are used in the context of energy efficiency are described in Section 2.2.1. On the other hand, Section 2.2.2 provides a study of the distribution of the previously broken down policies among the 17 nations in the sample. Section 3 is concentrated on the survey we conducted of 43 financial institutions, resent in the same 17 countries analyzed in Section 2. Initially, section 3.1 will explain the purpose and intent of the survey and how the questionnaire was conducted. Results are shown in section 3.2.1, indicating the different knowledge and use of energy efficiency policies among different sectors, types and topics. Section 3.2.2 illustrates the use of EPCs in the financial products offered among the respondents. Finally, two best practice

² According to Article 11 of Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (recast) Member States shall lay down the necessary measures to establish a system of certification of the energy performance of buildings. The energy performance certificate shall include the energy performance of a building and reference values such as minimum energy performance requirements in order to make it possible for owners or tenants of the building or building unit to compare and assess its energy performance. As a result, Member States have the opportunity to define the national layout and labelling of their EPCs in accordance with the definitions of the Directive

³ In some EU countries the average home consumes about twice as much energy to heat per square meter as homes in other countries with similar climates. For instance, Denmark is currently one of the most energy-efficient nations; since 1975, the amount of energy needed to heat one square meter of residential space has decreased by over 50%. (IEA, 2022).

case studies of support actions are presented in Section 4. Section 4.1 explains the policy and incentive measure introduced in May 2020, outlines its structure, and offers insights into its advantages and disadvantages to the national economy. Section 4.2 discusses how the KfW Development Bank has promoted energy efficiency measures to encourage energy-efficient renovations of buildings and ultra-low energy construction. In addition to its structure, the principal results and potential for replicability are proposed.

2. Differences among EE policies

2.1 Description and main differences between support actions and regulatory instruments, country distribution

2.1.1 Definition and main differences

EU countries share a common goal of improving energy efficiency in the residential sector, though they use various tools to achieve it. In this section, we will investigate European nations' energy efficiency programs to discover the resemblances and dissimilarities in the use of energy efficiency policies. The objective is to develop a comprehensive picture that can highlight the contrasts and different methods of the selected countries once we have determined the distinct approaches of the nations. To do this, we begin our analysis by dividing energy policies into two groups, regulatory and supportive. The comprehensive work of Thonipara et al. (2019) defines **support action** as economic and fiscal instruments based on a government that influences market mechanisms through subsidies, loans, taxes, and rights concessions. They have a voluntary nature as they stimulate the involved actor to act in a certain way by rewarding or financially discouraging specific behaviours. The usage of economic and fiscal instruments in principle, can create the economic conditions to establish functioning markets. The advantage of these instruments is that they can improve market failure, particularly for common goods for which markets do not exist. However, the possibilities to develop and manage these market failures with financial instruments are complex. Disadvantages are the costs associated with the subsidies. Loans or taxes themselves require coordination programs to distribute or collect the money. Also, financial incentives can prevent compliance for other reasons, such as intrinsic motivations. Finally, the competition for funds between stakeholders can lead to high transaction costs and much frustration on their side.

Regulatory instruments are legal, enforceable 'command and control' mechanisms that regulate the behavior of individuals and/or businesses in order to achieve desired, defined environmental quality targets or performance criteria. (Govinda & Timilsina, 2009). Instruments of regulatory nature can include requirements on various household appliances, products, systems, or entire buildings. (Lee & Yik, 2004). The main feature of a regulatory instrument policy is the establishment of binding requirements, which in case of noncompliance are followed by sanctions to shape the behavior of actors. It has a limited capacity, compared to support action policies, to deal with dynamic and complex situations. On the other hand, they are particularly effective in achieving specific goals (IEA (2010), ICER (2010)).

Our study attempts to examine the internal European distribution of energy efficiency programs. We specifically examined the distribution of support actions policies and regulatory tools in 17 European countries' energy efficiency programs. The sample includes 659 policies in all, including both finished and ongoing ones. The types of policy measures put in place into consideration are delineated in Table 1 in brief.

Table 1. Categorization of policy measures

Support Actions	Financial policies, fiscal policies, market-based instruments
Regulatory Instruments	Mandatory information, mandatory standards

Source: Authors' compilation, (Mure Database, 2022)

Moreover, it is noteworthy that policy does not always apply to one specific category; there can be overlap, so some policies may fall into multiple categories; table 2 illustrates the cases in our sample.

Table 2. Subcategorization of policy measures

FINANCIAL	FISCAL	MANDATORY INFORMATION	MANDATORY STANDARDS	MARKET-BASED INSTRUMENTS
Financial	Fiscal	Mandatory information	Mandatory standards	Market-based instruments
Financial - Fiscal	Others, Fiscal	Mandatory information, Information/training	Mandatory standards - Financial	Market-based Instruments, Others
Financial - General programme		Mandatory information, Information/training, Market-based instruments	Mandatory standards - Financial, Market-based Instruments	
Financial - Information/training		Mandatory information, Mandatory standards	Mandatory standards, Fiscal	
Financial - Information/training - Market-based instruments			Mandatory standards, Information/training	
Financial - Information/training - Others			Mandatory standards, Mandatory information	
Financial - Mandatory information			Mandatory standards, Market-based Instruments	
Financial -Mandatory standards			Mandatory standards, Others	
Financial - Market-based Instruments				
Financial - Others - Information/training				

Source: Authors' compilation, (Mure Database, 2022)

2.1.2 Country distribution

Using the previously defined and illustrated policies, we will analyze their distribution within the sample. The study examined 17 EU member states to provide a comprehensive picture of the current energy policy framework in parts of Europe and catch what energy policy typologies are implemented in each country. We start by classifying policies into two main categories: support actions and regulatory instruments.

Figure 1. Distributions Support Actions and Regulatory Instruments



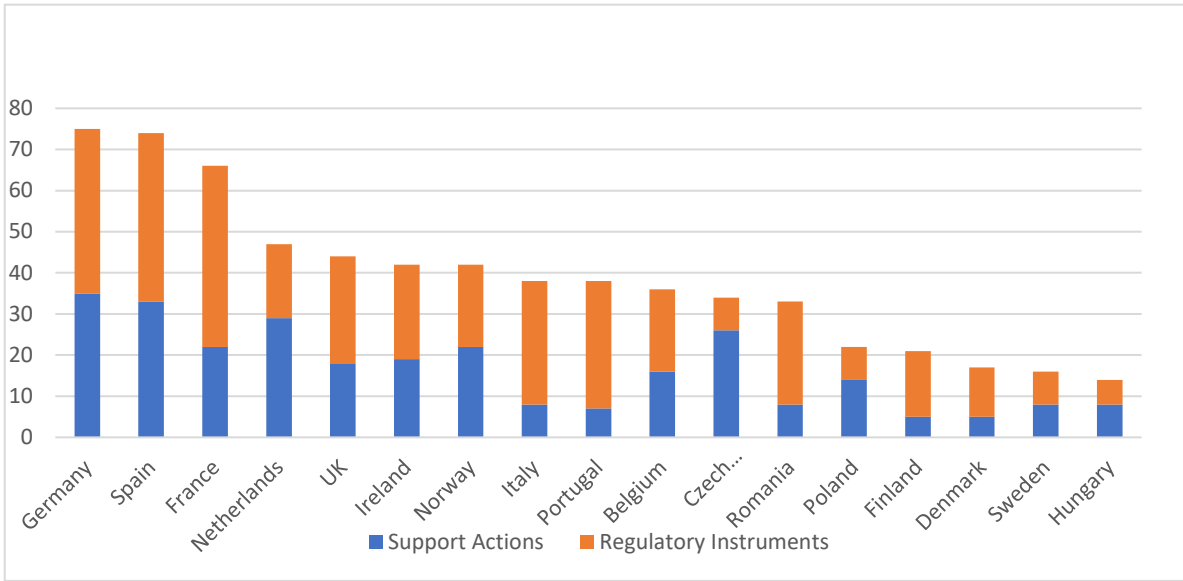
Source: Authors' compilation, (Mure Database, 2022)

It was found that of the 17 countries that were chosen, a total of 57% of policies were regulatory. In absolute terms, support actions amount to 283 policies. Overall, the distribution outcomes are evenly distributed.

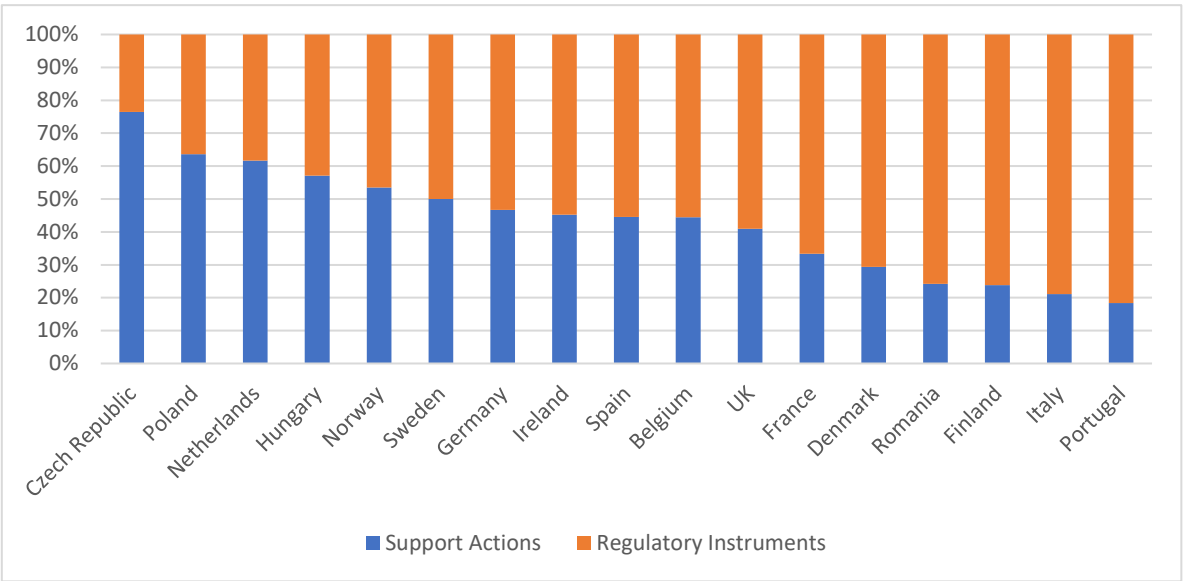
To understand the critical differences in Europe's energy efficiency programmes, Figure 1 draws a picture of the whole distribution by country. As a result, we can see how each country in the sample implements the two types of energy efficiency policies. As expected, the majority of countries, 11, have more regulatory policies compared to the Netherlands, Norway, Czech Republic, Poland and Hungary, which have a prevalence of support actions.

Figure 2. Energy efficiency policies distribution by countries

2.a



2.b



Source: Authors' compilation, (Mure Database, 2022)

In absolute values, the countries with the majority of supportive policies are the Netherlands, Norway, Poland, Hungary and the Czech Republic; the latest counts the highest number overall, 18 supportive policies. Sweden, in the sample analyzed, is the only state with an equal distribution among the two types of policies. Although when dividing supporting policies by regulatory instruments, the Czech Republic, Poland, and Netherlands produce a majority of supporting policies relative to other countries.

Generally, there is evidence of a balanced distribution between the two policies in the countries surveyed. In short, the countries with the most significant number of active policies are the countries with the slightest difference in the number of support actions and regulatory instruments, such as Germany, Spain and France. In the next section, we will explore the subcategories of support actions in greater detail, focusing mainly on the financial policies that comprise the majority of policies.

2.2 Focus on financial and fiscal tools

2.2.1 Definition and main differences

Energy tax policy has recently offered incentives meant to encourage the purchase and usage of specific energy technology, as noted by Neveu & Sherlock (2016).

Therefore, it is crucial to define the various measures that offer financial facilities to encourage private capital investment and tax incentives that indirectly reduce the cost of investment, increase consumer information, and address the landlord-tenant problem. There are many forms of financial incentives available - grants, subsidies, soft loans, etc. - and they are commonly used to encourage energy efficiency improvements by lowering households' upfront costs (Trotta et al., 2018).

Some studies (Koengkan (2022), Villca-Pozo & Gonzales-Bustos (2019), Neveu, A., Sherlock, M. (2016)) argue that energy standards may not be fully achieved due to implementation problems. However, combining building energy standards with financial incentives will provide more comprehensive results. Koengkan et al. (2022) notice how Finland and the United Kingdom have implemented several energy efficiencies tools in the residential sector but have yet to achieve the desired goal, while Hungary, Spain, and Italy have achieved the desired results using financial incentives.

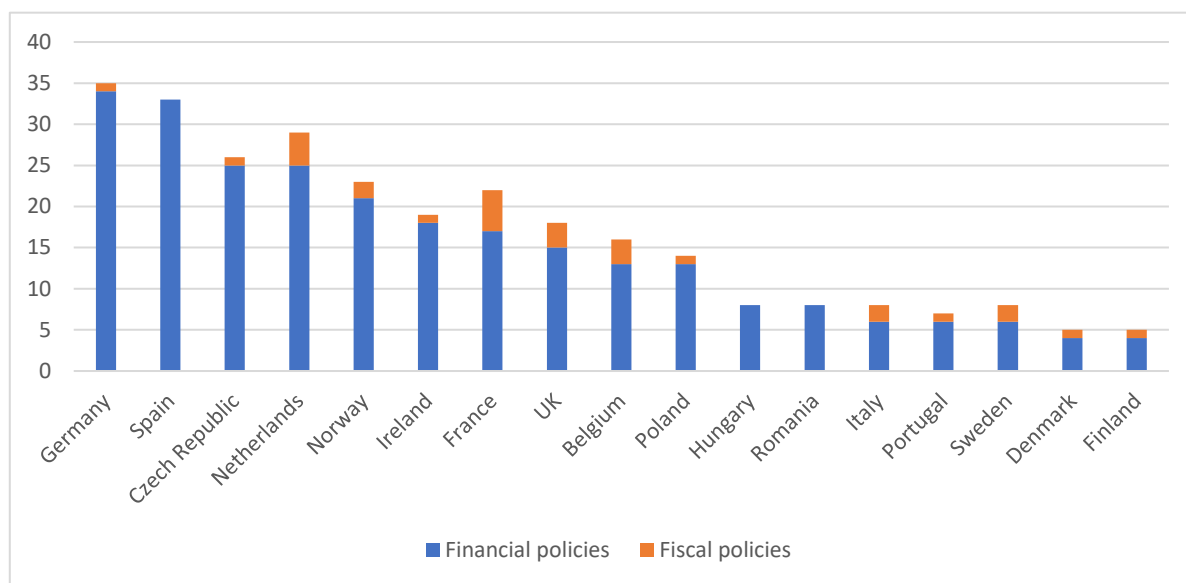
2.2.2 Country distribution

As explained in Table 1, supportive policies fall into two categories, financial and fiscal.

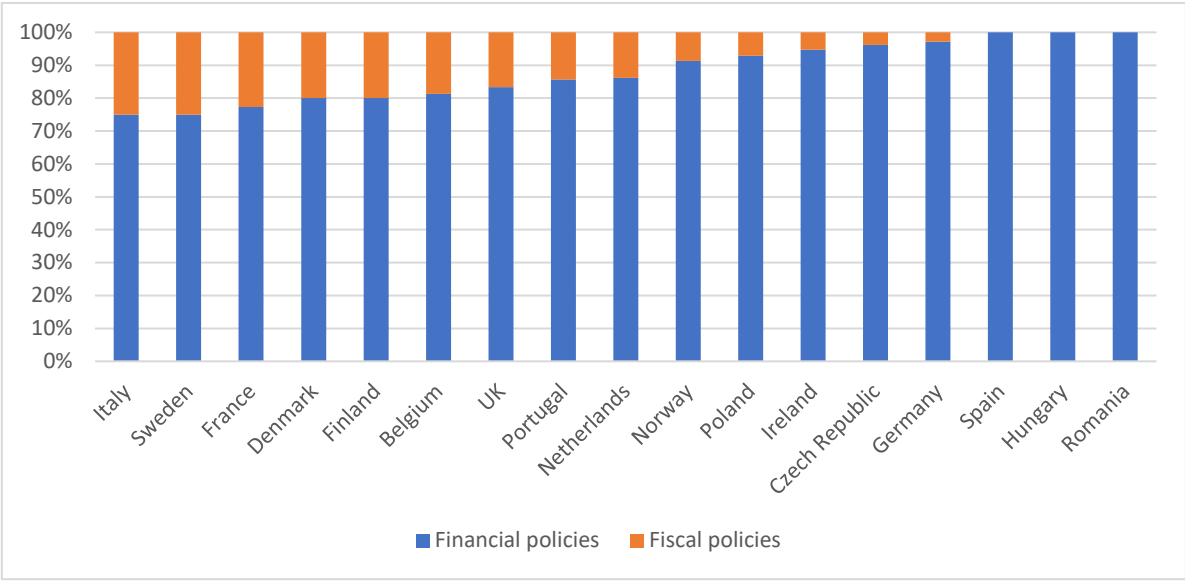
There is a significant difference in the distribution of the two policy types in the selected countries; fiscal policies account for 27 of the policies, while financial actions account for nearly ten times as many (256).

Figure 3. Support Actions distribution by countries

3.a



3.b



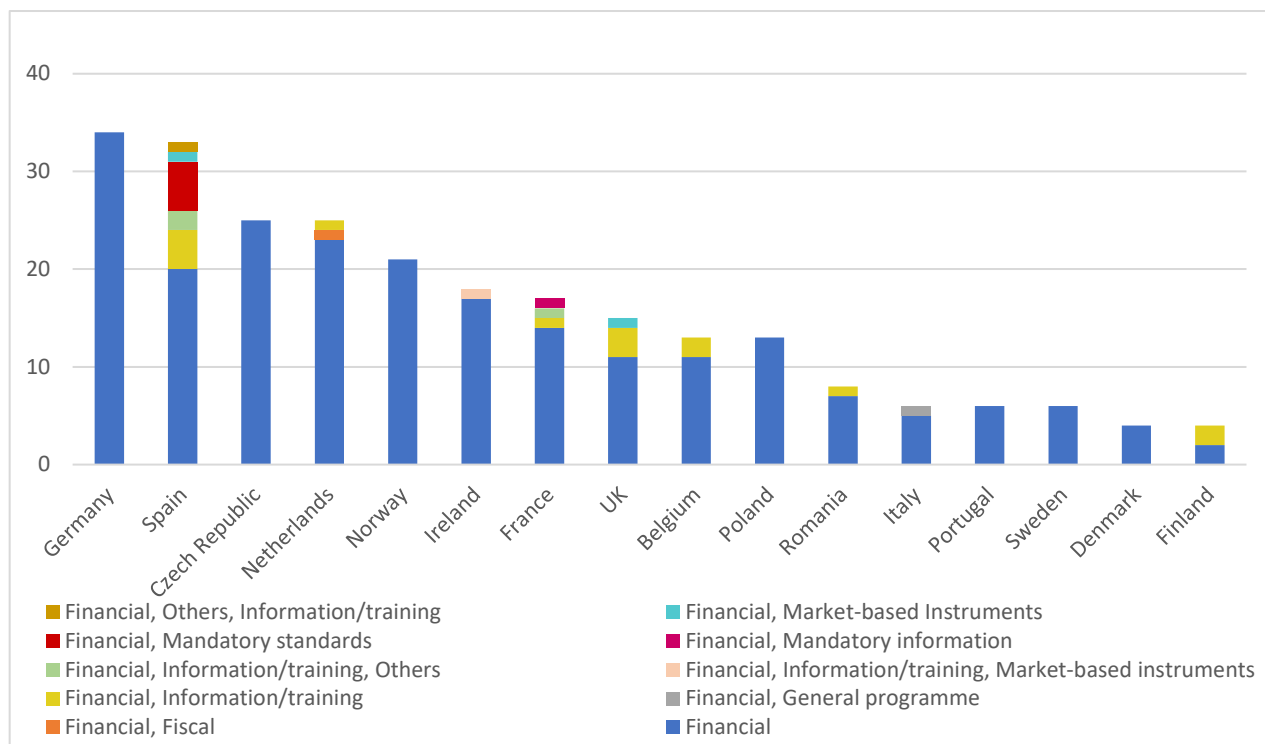
Source: Authors' compilation, (Mure Database, 2022)

Financial policies account for 90% of all policies, indicating a clear majority in the preferred type of policy among the selected countries. Moreover, the distribution of the two categories of policies within nations is relatively alike; in all countries, there is a substantial majority of financial policies over fiscal policies. Hungary, Romania, and Spain are the countries where there are no fiscal policies. The latter is among the countries with more financial policies, 33 in absolute terms, second only to Germany (34). Additionally, of the 14 nations with fiscal policies, France, Sweden, and Italy have the most varied support actions relative to other nations, as seen in figure 3b.

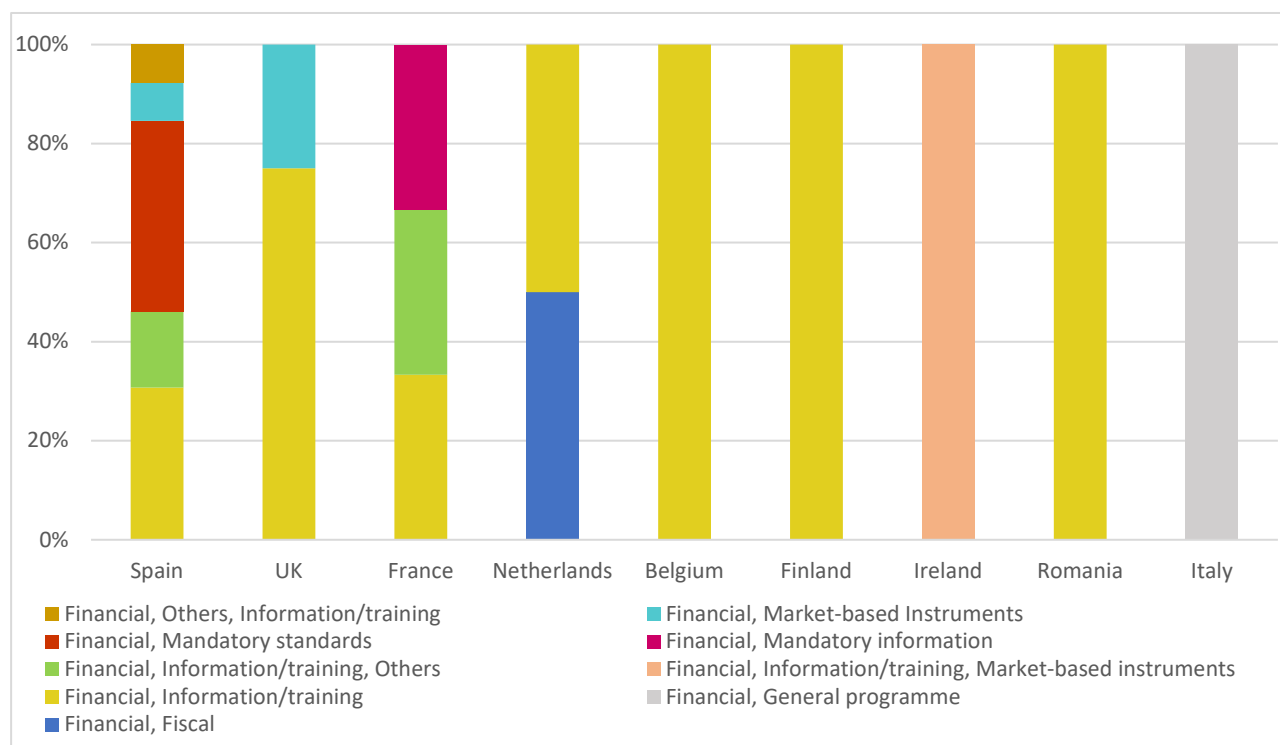
There are various categories of financial policies, as shown in [Table 2](#), and are examined by country in Figure 4. In the upper part of the figure are listed and compared by countries, all the types of financial policies. *Financial policy* types make up 89% of the sample. Figure 4b provides a relative breakdown of all the other subcategories to help differentiate them and determine better how they are allocated among the countries.

Figure 4. Financial policy types distribution by countries

4.a



4b.



Source: Authors' compilation, (Mure Database, 2022)

Germany, Spain, and the Czech Republic have the majority of financial regulations, whereas Sweden, Denmark, and Finland have fewer than five. Spanish policies have a considerable number and, above all, the

highest variance of different types of policies, including six types of financial support actions enacted, as shown. A total of only seven countries reports non-financial policies out of the remaining sample. These countries include the Netherlands, Ireland, France, England, Romania, Portugal, and Finland.

We may already infer important and preliminary conclusions from the report's first section. Overall, the type of policies with the most significant presence in our sample is the regulatory type, compared to the other analyzed type, support action (figure 1). Among the latter, there is a relevant difference found. There are ten policy subcategories among financial policies, while the fiscal ones have only one type (table 2). This part of the results is even more interesting when considering how energy efficiency policies divide countries. In all graphs, Germany and Spain are the two countries with the majority policies. The only chart where this is not the case is 4. b, where Germany is not even present since it has no policies that are not solely "financial." After obtaining the findings of this study, we further broaden the picture of energy efficiency in Europe by incorporating the findings of a survey that aims to delve even further into how energy policies are used by, in this case, financial institutions that provide financial products for energy efficiency.

3. Survey

3.1 Aim and objective of the survey

EEM's primary purpose is to deliver an integrated market and a blueprint for established and emerging global markets. The project analyzes the current market systems and their relevance in developing an EEM market and establishes demonstrators to support the end-to-end customer journey and EEM life cycle. To determine the accuracy of the analysis conducted so far and, at the same time, expand its content, a survey was submitted to all EEM Initiative lenders that are part of the EeMMIP project. EeMMIP responds to the objectives of the EU in the areas of sustainable finance and climate change, and strives to influence the entire value chain, stimulate mentality change, and secure energy efficiency in market attitudes and best practices in Europe and globally. The online survey tool LimeSurvey is used to collect anonymous responses, and results are presented by country.

Table 3. Type of financial institutions surveyed

Universal banks	Building society
Credit Institutions	Foundation
Mortgage bank	Insurance group
Loans company	Real estate financier

Data source: Authors' compilation (EeMMIP database 2020)

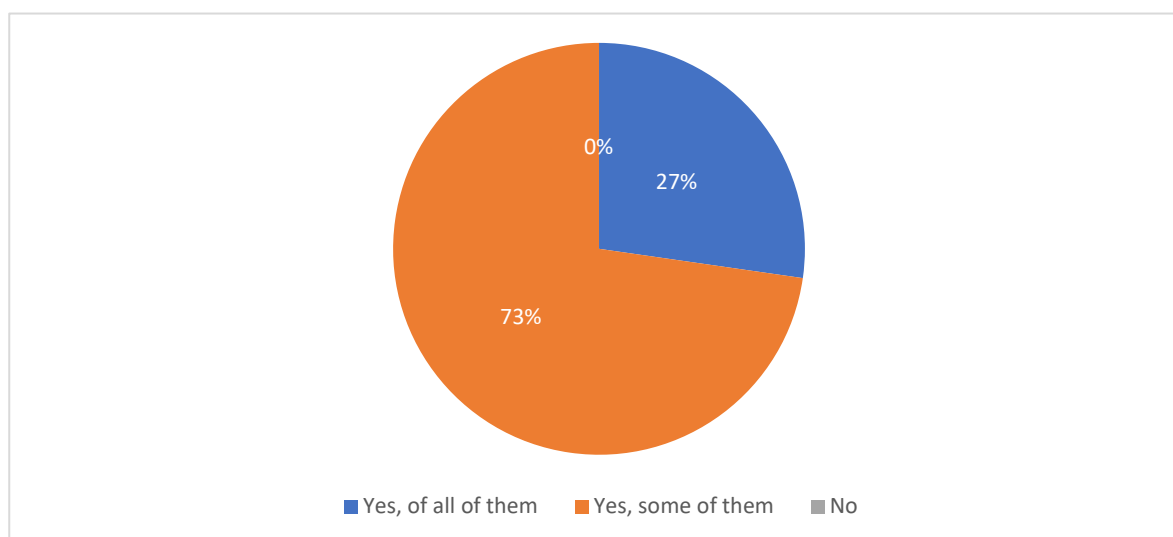
The questions are intended to define how financial institutions are aware of the current network of energy efficiency policies, how they evaluate the active policies among the different types and sectors, and finally, how their financial products directly related to energy efficiency issues are used. The questionnaire sent to 66 total respondents received 43 total responses, of which 17 were complete in all parts.

3.2 Results on the use of energy efficiency policies

3.2.1 Different use in sectors, types and topics

Although, there was the awareness that we had interviewed a well-prepared sample interested in the topic of energy efficiency, the purpose of the questionnaire's first component is to ascertain the respondents' overall familiarity with the most recent energy efficiency policies.

Figure 5. Q: Are you aware of EU energy efficiency policies in force in the area where your financial institution operates?

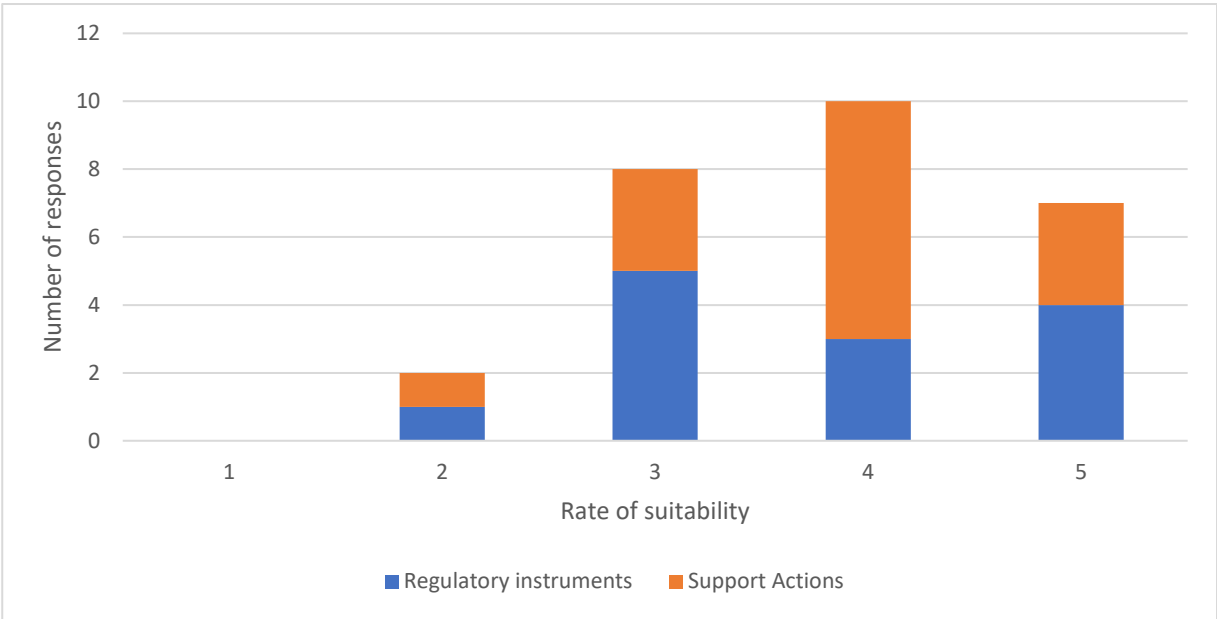


Data source: Authors' compilation (collected answer from questionnaire 2020)

Figure 5 shows the survey's question in the title and in the pie chart the percentage of responses for each of the three options. The replies show that, all respondents are aware of energy policies, though most are only aware of them in part. In light of the surveyed sample being financial institutions that offer energy-efficient financial products, it should not be surprising that all respondents are aware of local energy-efficiency policies.

In the second part, the survey asks participants to rate the EE policies implemented in the last ten years (regulatory instruments or support actions) according to their suitability for their financial products. The graph regroups the answers according to the obtained ratings on a scale from 1 to 5; frequencies are shown in absolute values on the y-axis.

Figure 6. Q: Energy efficiency policies can be classified into two listed types: Regulatory instruments that settings binding requirements -Support actions that represent economic and fiscal instruments. Please rate their suitability for your financial products on a scale of 1-5 (where 1 is the least effective and 5 is the most effective).



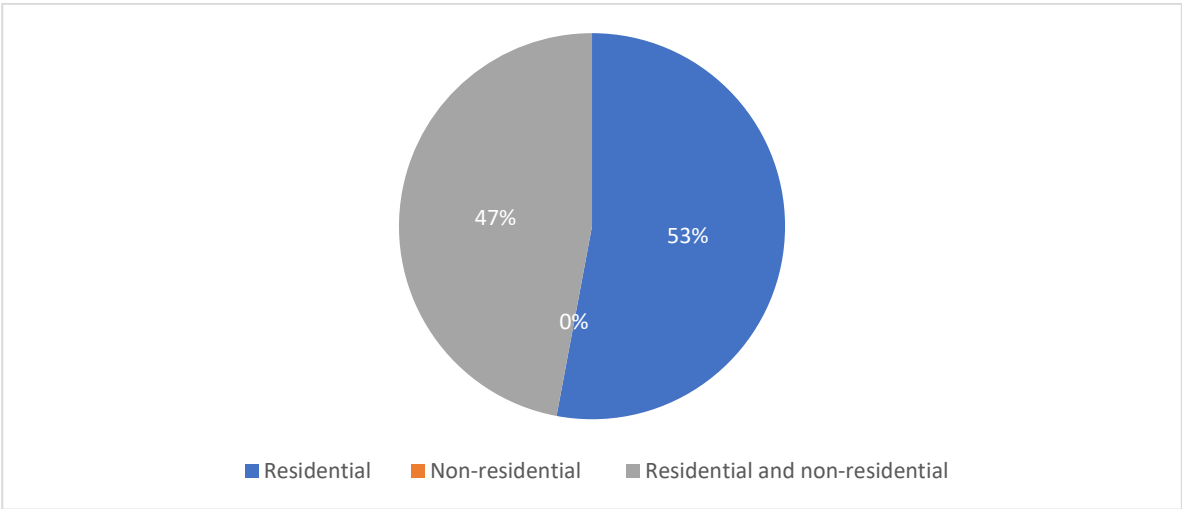
Data source: Authors’ compilation (collected answer from questionnaire 2020)

According to the collected data, more FIs have attributed the highest score (5) to regulatory instruments, comparatively to support actions, selected only by 3 FIs. Concerning rating level 4, support actions present a large predominance. Rating score 3, similarly, to rating level 5, is more favourable to regulatory instruments and rating level 2 is more often attributed to support actions. Rating level 1 has been selected just by one FIs and was concerning regulatory instruments.

Thus, in absolute terms, the responding FIs have rated as more suitable for their financial products the supportive actions and most of them have provided a score of 4. This observation confirms the idea that market-based policy tools are more easily integrated by most economic actors, since they provide clearly perceived benefits and incentives, but also induce lower social costs and thus require lower financial efforts.

Furthermore, respondents are asked to indicate their preferences depending on the destination sectors: residential and non-residential.

Figure 7. Q: Energy efficiency policies are designed for two different sectors: residential, non-residential, or both. Please choose the one more suitable for your financial.



Data source: Authors’ compilation (collected answer from questionnaire 2020)

According to the obtained answers, a slightly predominant part of (53%) considers the existing EE policies suitable for their financial projects targeting the residential sector. Surprisingly, no financial institutions has indicated that the current EE policies are adapted to their solely non-residential sector specific products. The FIs operating in Spain and Belgium indicate that the current EE policies are adapted to both their residential and mixed residential-non-residential sector products. Both France, Netherlands and Romania have indicated that only their residential sector targeting products are compatible with the existing EE measures. While, in Italy, Sweden and Ireland, it is the case for the mixed residential-non-residential products. The Netherlands and Italy concentrate the largest shares of FIs evaluating the utility of EE policies respectively for residential products and mixed residential-non-residential financial products.

This observation indicates that the participating to the study FIs, do not consider the implemented EE policies adapted to their products relative solely to the commercial buildings sector. Two major discussions can be hence raised: 1) either there is a necessity to develop EE policy tools more adapted to commercial buildings or 2) there is a necessity to improve the understanding among FIs how to transpose the EE policy frameworks to non-residential products. In both cases, given the importance of the EE potential of commercial buildings and the relatively less demanding in terms of administrative costs procedure (lower number of owners compared to a condominium), a solution should to this issue should be found.

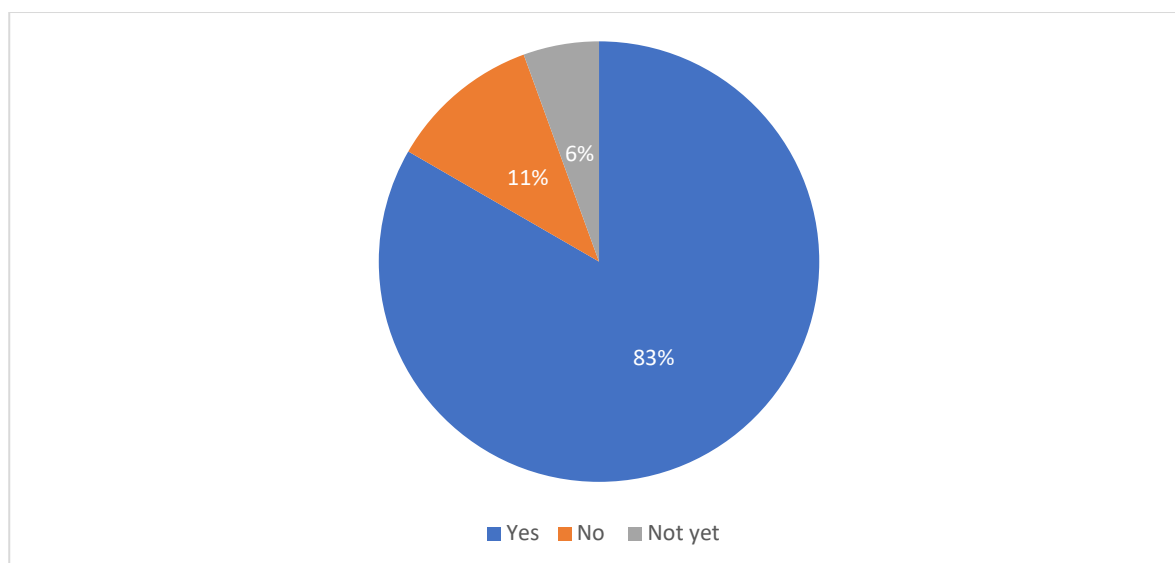
3.2.2 Use of EPCs in the offer of financial products

The Energy Performance Certificates (EPCs) were introduced in 2002 by the Energy Performance of Buildings Directive (EPBD) 2002/91/EC as a mandatory requirement for the EU Member States (MSs). The recast EPBD (2010/31/EU) reinforced the EPC obligation, recognizing the importance of independent quality control (Art. 18) in the residential sector. The EPC rate allows to evaluate the energy performance of buildings and thus, is vital for increasing the accuracy of available data and for creating and sustaining market confidence. Therefore, its accuracy and its capacity to be comparable among all EU members is of prime importance. In consequence, the present section will focus first on the EPC Quality Assurance scheme (describing the general EPC framework adopted by each MS), followed by a survey evaluating the use of EPC ratings among FIs in the EU.

Data on EPCs at the European level varies greatly and, for this reason, a qualitative approach is applied to compare the different use and process of calculating EPCs. To delve deeper how advisory committee members evaluate EPCs and their use, the last part of survey is asks.

The first question of the survey aims to provide a general picture of respondents' overall use of energy efficiency related financial products.

Figure 8. Q: Does your Institution offer any financial products at national level related to energy efficiency?

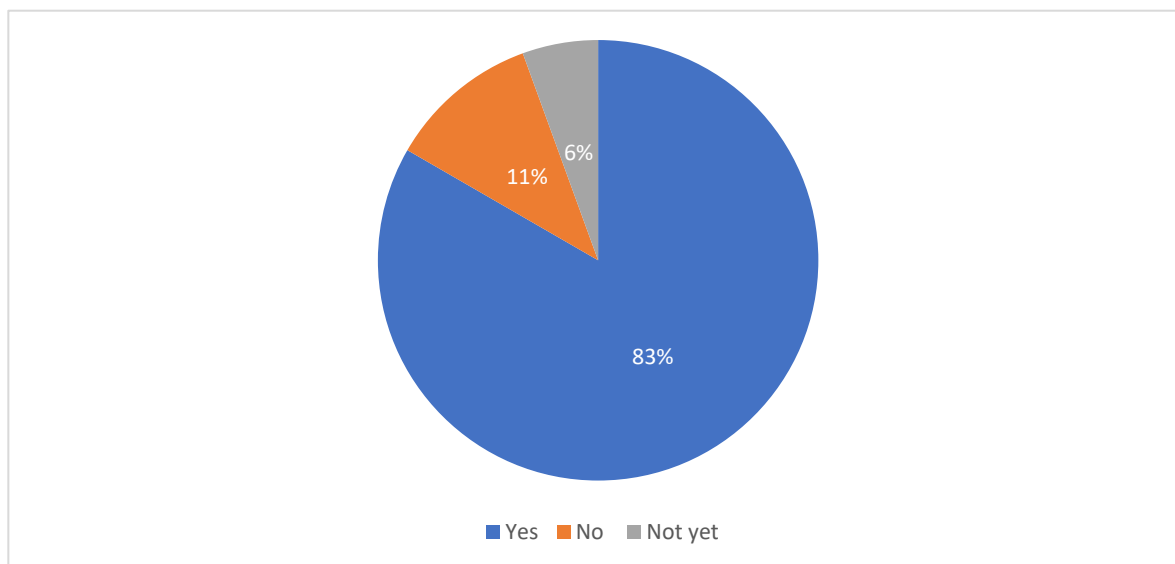


Data source: Authors' compilation (collected answer from questionnaire 2020)

The graph demonstrates that the majority of the financial institutions participating in the poll actively offer financial products related to increasing energy efficiency, and the minority does not use such items.

Furthermore, as shown in figure 9, not only most of the surveyed FIs use energy efficiency related products, but also a large majority of these products include direct use of EPCs.

Figure 9. Q: Do your institution's financial products at national level related to energy efficiency include the use of the Energy Performance Certificate?



Data source: Authors' compilation (collected answer from questionnaire 2020)

The majority of respondents answered that they use EPCs in their financial products, whereas only a tiny portion do not use them. In addition, among the comments to the question, two respondents specified that they do not use EPC currently but intend to, in the graph indicated as "Not yet".

From this question, the survey changes based on the response ("Yes" or "No") provided. All respondents who choose "Yes" are asked to explain how they leverage EPC information via an open-ended response. Each of them requires the EPC information in order to take out a mortgage or, in some cases, provide a loan. What

changes the most across institutions is the eligibility to obtain an EEM. In most cases, it is a minimum label, ranging from C to A; other times, it is a label enhancement that must occur to obtain financing.

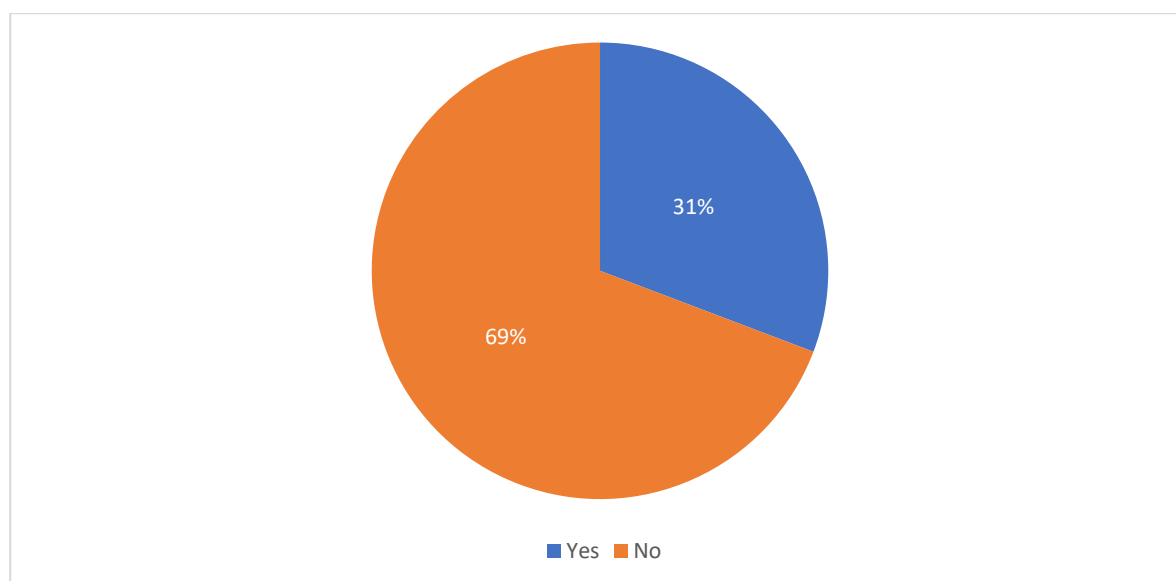
Finally, for the same subgroup of respondents (offering financial products and requiring EPCs), an additional question is asked: "In addition to the energy performance certificate, what other information is required to provide your energy efficiency financial products (e.g., primary energy demand, appraisals, certifications, data sheets)?" The majority did not request additional information or did not respond.

In contrast, some in-depth data were provided. For example, an institute operating in Spain explained how energy certificates and a reduction in primary energy demand (PED) are required in the case of a renovation. To calculate the actual improvement of the property, a minimum threshold of 30 % energy efficiency improvement on the property, resulting from an actual reduction in PED, must be achieved within three years. Another alternative approach, given by respondents, is an appraisal by a certified expert of all energy improvements and benefits of a home. It is used whenever a mortgage is involved in purchasing, refinance, or selling the property.

Differently, FIs answering "No" to the question represented by figure 10 are either developing new EPC-based products and launching them in the near term or are not considering yet to offer similar products.

The last part of the questionnaire seeks to investigate the use of EPCs for financial products offered internationally. Again, depending on the chosen answer, specific questions are asked to determine the methodologies used by the institutions.

Figure 10.Q: Does your Institution, not only your branches, offer any financial products on an international level related to energy efficiency?



Data source: Authors' compilation (collected answer from questionnaire 2020)

Most institutions do not offer international financial products related to energy efficiency. According to the sample, the main reason financial products are not offered abroad is the lack of demand on the international market. We asked institutions that operate energy efficiency products in the international market, i.e., all those who answered "Yes" to the question in figure 10, how they perform internationally. Only a small number of surveyed indicated that they operate at most in another one country abroad.

In addition, when asked how they handle the domestic differences in the energy efficiency product, a portion of the sample stated that they have equivalent activities of the different branches but are proposed in different ways according to the market specifics. The other proportion of the sample, responding to this

question, indicates that they are able to offer identical products in the international and national markets since the two share similar characteristics.

Together, these results provide important insights: most of the respondents use EPCs in their financial products and find them a helpful document for their business but find several problems in offering their products internationally due to incompatibility between different countries.

Survey results show good sample knowledge of energy efficiency policies (figure 5) with a preference for supportive ones (figure 6) and for the residential and non-residential sectors. The use of financial products related to energy efficiency is prevalent in our sample, with equally high use of EPCs among the financial products offered. On the other hand, products offered internationally still need to be made available in our sample. The last part of the report now wants to take two best practices as examples to analyze in detail how support action policies on energy efficiency take shape in the course and use the two cases investigated to determine the strengths and weaknesses.

4. Case Studies

4.1 Superbonus 110% (Support Action, Italy)

The first relevant energy-efficiency policy was introduced in Italy with the SAVE directive to optimize the efficiency of electrical and air conditioning systems. In 2002, the European buildings directive, the EPBD, was implemented for the first time. Over the years, there have been amendments and revisions, in 2010 and 2018, to comply with the more stringent targets in the building sector dictated by the European Union.

The Superbonus 110% was introduced in 2019 by the decree "Urgent measures on health, support for labor and economy, as well as social policies related to the epidemiological emergency from COVID-19" (Decree Law May 19, 2020 No. 34 converted into Law July 17, 2020 No. 77). The energy improvement must be demonstrated by the energy performance certificate EPC (Article 6 of Legislative Decree No. 192/2005), issued by a certified technician before and after the intervention.

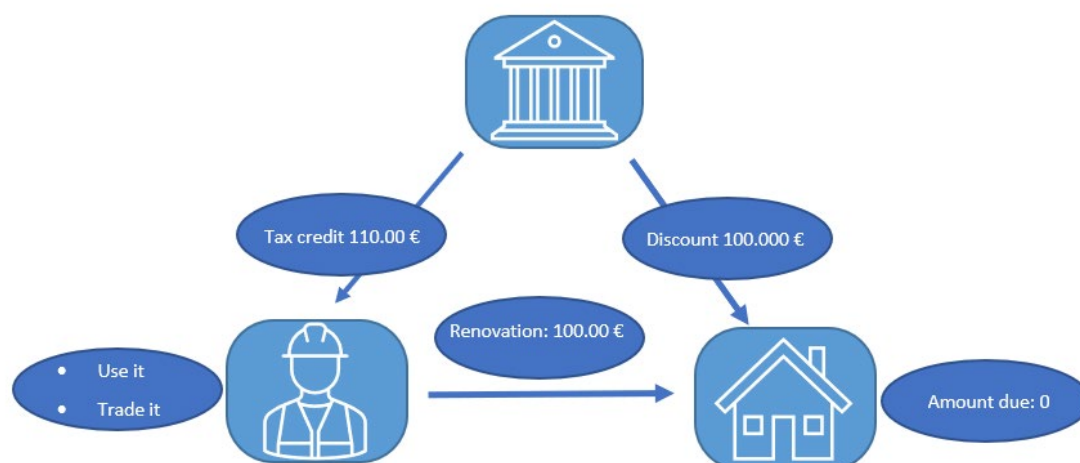
The measure is a tax credit on energy efficiency expenditure, subject to conditions and on a temporary basis (until the end of 2025). Once energy-efficient building renovations have been made, the homeowner gets 110 % of their spending as a tax credit.

The beneficiary has three choices after becoming eligible for the tax credit:

- Use it to offset their liabilities to the government (government and local taxes, social security contributions)
- Trade it with other taxpayers (including companies).
- Swap it with the company that does the work in exchange for a 100% invoice discount over five years, with equal instalments for each year.

According to BPIE (2021), the opportunity to transfer tax credits is the crucial feature of the Superbonus 110%.; this aspect of the program is intended to allow small taxpayers (such as property owners or small to medium-sized businesses in the construction industry) to transfer the advantage to larger taxpayers. With the invoice discount, the tax credit can be given directly to the business doing the work in exchange for a 100% invoice discount.

Figure 12. Superbonus 110% example financial features



Data source: Authors' compilation

Here an example to better illustrate the case. The company charges €100,000 for the renovation work and issues an invoice to the homeowner with a 100% discount. Thanks to the earmarked manoeuvre, the owner does not have to pay. The Italian state gives directly to the company a tax credit of 110,000€ (110% of the invoiced amount); the company can now decide whether to use it or swap it to another company or bank.

To whom it is addressed

The Superbonus 110% applies to interventions carried out by:

- Individuals who own or hold the property subject to the intervention
- Individuals, outside the exercise of business or profession, for interventions on buildings consisting of two to four housing units distinctly stacked, even if owned by a single owner or in
- co-ownership by several natural persons
- Institutions that meet the requirements of European "in-house providing" legislation
- Non-profit organizations, voluntary associations and associations for social promotion
- Amateur sports associations and clubs, limited to works intended only for buildings or parts of buildings used as locker rooms.

Drivers and towed interventions

The entire building, not the single dwelling, must advance at least two energy classes. The scheme provides a clear separation between the types of intervention; on the one hand, there are the **drivers**, listed below; once carried out, at least one of these there can carry out other types, defined as **towed**.

The Superbonus 110% is due in the case of:

- Thermal insulation interventions on the envelopes
- Replacement of winter air conditioning systems on common parts
- Replacement of winter air conditioning systems on single-family buildings or the building units of functionally independent multi-family buildings
- Earthquake-resistant interventions.
- Additional or trailing interventions

In addition to the interventions listed above, expenses for interventions carried out with at least one of the main interventions of thermal insulation, replacement of winter air conditioning systems or reduction of seismic risk are also included in the Superbonus 110%.

The **towed** interventions are:

- Energy efficiency interventions
- Installation of solar photovoltaic systems and storage systems
- Infrastructure for charging electric vehicles
- Interventions to eliminate architectural barriers

Opportunities and obstacles

The most recent data from ENEA (November 2022) show that 338,950 assertions have been made over the entire Italian territory since the initiative's inception. The total investments allowed is 58,112,523,439.14 €, and the one for completed works represents 71.3%, 41,423,688,054.03 € in absolute terms. Thus, demonstrates how the Superbonus 110% is revitalizing the construction sector and the professionals engaged, giving life to a field that had been stagnant in previous years that have a significant impact on GDP.

The ability for owners to completely improve a house without incurring any costs is the main advantage. The ability for owners to completely improve a house without incurring any costs is the main advantage. Some of the most efficient upgrades include thermal insulation with insulation coatings, replacing windows and doors, shutters, heating systems, air conditioning systems, and radiant systems, and installing photovoltaic and thermal solar panels. A complete home renovation, resulting in lower electricity and gas bills, completely free of charge.

The second advantage is related to the transfer of credit to banks or firms performing the work. In this case, the credit assignment institutions and banks are the beneficiaries. Institutions can purchase tax credits from citizens, providing them with the cash needed to pay for the work. In this way, even those who do not have tax capacity, that is, those with low incomes can benefit from a very high tax deduction without any problem. Nevertheless, even those with minor financial capacity can completely renovate their homes by assigning credit to the companies that carried out the work or banks.

Very stringent procedures and complex bureaucratic processes are the main deterrents to this measure. Given the essential initial design phase and the complexity of the work, time is little, and there is a risk of having to pay for a project that later cannot be realized. Alternatively, if one wants to complete the transaction with a credit transfer, one must also obtain a loan from a bank. The bureaucracy involved in the banking process further extends the time and increases the risk of failing to complete the procedures in time.

Ensuring compliance with the requirements, moreover, cannot go without a preliminary feasibility study, in which a technician must analyze the property, carry out the energy certification (if absent), remedy any cadastral or urban planning irregularities and, only after that, can express an opinion on the type of interventions to be carried out to ensure the jump of the two classes. All this planning phase, inevitably, has costs, which can be reimbursed only if you proceed with the work, while they are "lost" if you do not proceed.

In conclusion, for Italy to meet the 2030 and 2050 European targets, energy efficiency is a vital issue, and, despite the complex bureaucracy involved in obtaining credit, the eco-incentive introduced by the Relaunch decree offers an excellent opportunity for renovating Italy's building stock.

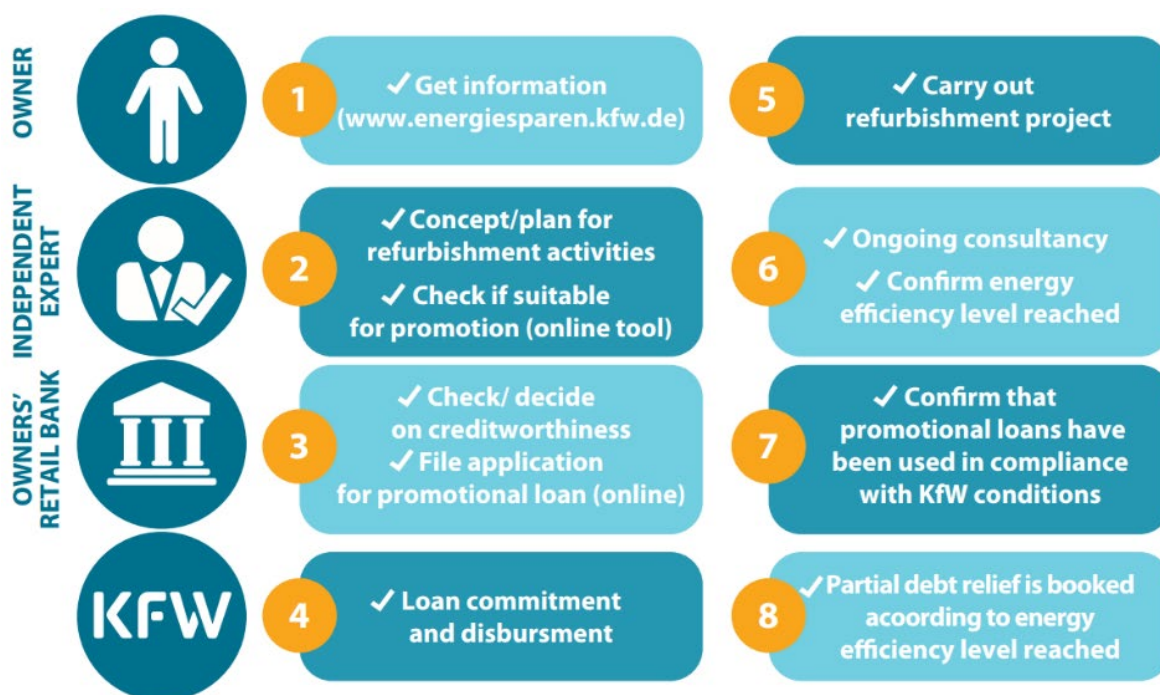
4.2 KfW programme (Support Action, Germany)

The long-term goal of the German energy and climate policy includes an ambition to achieve an almost climate-neutral building stock by 2050. The financial promotion of energy efficiency measures is one of the three pillars, alongside legal requirements and information campaigns, towards this objective, and key to a successful energy transition (“Energiewende”) – the long-term shift to renewable energy and energy efficiency, including nuclear phase out. Goals for 2020 included a reduction in greenhouse gas emissions of 40% and an overall reduction in the heating demand of residential buildings of 20%.

On behalf of the German Government and the Federal States, the KfW Development Bank provides a bundle of programmes, including subsidies and low-interest loans, to encourage energy renovation of buildings as well as the construction of new buildings with very low energy requirements.

The funding programmes set up by KfW (both historic and current programmes) target residential, municipal and social service buildings. They offer long-term, low-interest loans for comprehensive (deep) refurbishment as well as single measures, as long as they meet minimum technical requirements. Funding is also available for the acquisition of a newly refurbished building.

Figure 13. Overview of the KfW scheme structure



Data source: Authors' compilation

Three key pillars form the cornerstone of the KfW scheme.

- Regulation to reduce energy demand and promote renewables;
- Creation of financial incentives and stimulating investment to reduce energy demand and promote renewables; and
- Providing energy saving information and advice.

The KfW schemes are designed to specifically promote deep renovation following the motto: “The deeper the renovation, the higher the incentive”. To illustrate this point, a grant of 25% is offered if the refurbishment reaches the most ambitious KfW Efficiency House 55 standard, while the slightly less ambitious level of KfW Efficiency House 70 attracts a lower grant of 20%.

Figure 14. Grants offered in the KfW scheme.

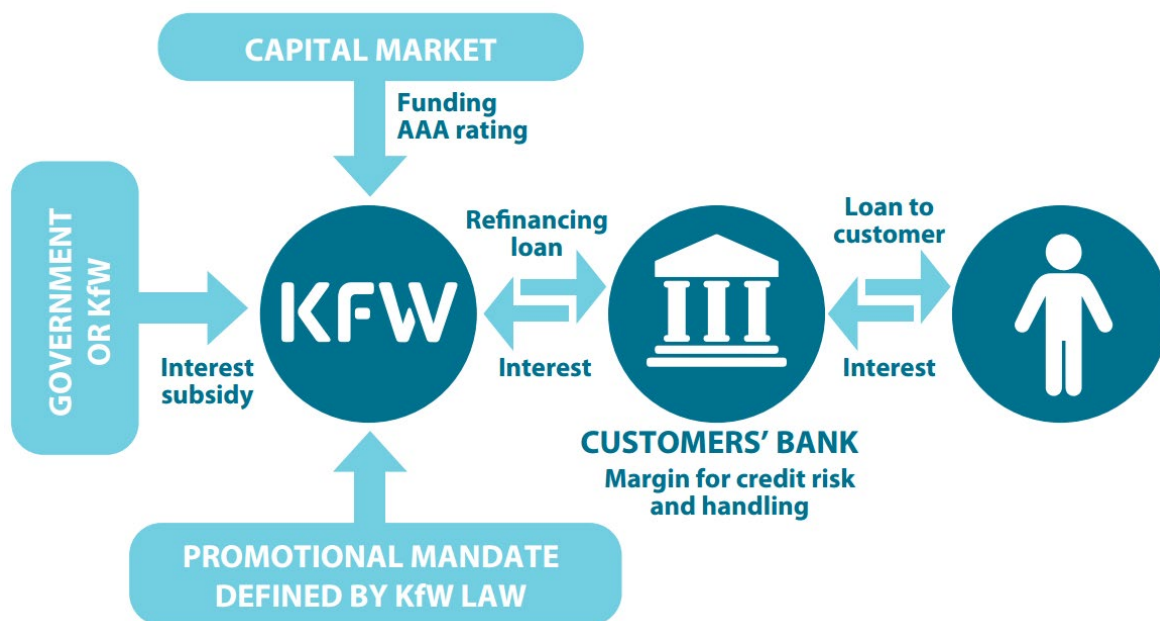
LEVEL OF ENERGY EFFICIENCY	INTEREST-SUBSIDISED LOAN AND REPAYMENT BONUS	OR GRANT
ENERGY EFFICIENCY HOUSE 55	0,75% P.A. EFFECTIVE	27,5%
ENERGY EFFICIENCY HOUSE 70		25%
ENERGY EFFICIENCY HOUSE 85		22,5%
ENERGY EFFICIENCY HOUSE 100		20%
ENERGY EFFICIENCY HOUSE 115		17,5%
ENERGY EFFICIENCY HOUSE MONUMENT		15%
ENERGY EFFICIENCY HOUSE 70		12,5%
		10%
		10%
		10%

Data source: Authors' compilation

Financial features

KfW obtains its funding from the capital markets, where it benefits from a AAA credit rating and a 100%-guarantee from the German government. KfW doesn't have branches of its own, but instead distributes its products via private retail banks and insurance companies (see below). The KfW business model is competition-neutral ie all banks have access to KfW support. Clients benefit from a transparent scheme with clear conditions. As private banks are in charge of risk assessment, the credit risk is spread and as limited as possible within a nationwide financial scheme. In most cases, local banks know their clients before they apply for funding, which makes the risk assessment much easier.

Figure 15. KfW financial features



Data source: Authors' compilation

Loans are encouraged by means of a repayment bonus which is higher than the grant option, and through subsidising the low interest loan (currently 0.75%) with a maturity of up to 30 years. This includes up to 5 repayment-free start-up years and a fixed-interest period of up to 10 years. The loan can cover up to 100% of eligible costs, to a maximum of €100,000 per housing unit for a KfW Efficiency House, and up to €50,000 for individual measures.

Impact and potential for replicability

KfW illustrates a best practice approach to deliver a high leverage of private investment from public funds. The annual public budget for KfW schemes targeting the building sector (including new buildings) was €1.8bn on average from 2012 to 2014. According to Germany's building renovation strategy, the average leverage effect is 1:12. In other words, for every €1 of public support, private individuals and companies have invested €12. In order to monitor the appropriate use of public money, the KfW programmes are evaluated annually by independent experts, financed by the Federal Ministry of Economics and Technology and KfW.

The KfW scheme is noteworthy by virtue of its scale, reach, longevity and its gearing towards deep renovation. According to an analysis undertaken in 2012 by the French energy agency ADEME, the level of support equates to €16 per head of population, compared to €10 or less for support schemes in other Member States. As such, it provides by far the largest level of funding per capita of any renovation support scheme in the EU. Even so, and while the level of uptake is quite good, there is has certainly been scope increase uptake yet further.

Another strength is its flexibility – adapting to changes in the Energy Saving Ordinance legislation, and to market conditions. With support levels linked to energy performance, the scheme encourages consumers to achieve deeper renovation while acknowledging that not everyone will be in a position to do so.

In summary, while the German KfW model benefits from a long tradition and the high financial reputation of the bank, the principles could readily be adapted to suit the prevailing conditions in other EU Member States. For instance, in the Czech Republic, the New Green Savings Programme has been modelled, to a certain degree, according to the KfW principles. While some aspects of the Czech delivery mechanism are different (for example, the scheme is administered centrally, rather than through retail banks), the loan/ grant structure geared towards deeper renovation is broadly comparable.

Germany's approach has given it leadership in reducing the carbon footprint of its built environment, and although cannot be transposed wholesale elsewhere, the approach holds a range of more general lessons for countries like Scotland which are at an earlier stage of the energy efficiency programme.

Germany has adopted a 'three-pillar' approach that integrates energy efficiency provisions into a clear framework of regulation, information and support for renewables. This has served it well, creating a strong, enforceable legal standard to underpin change and generating a clear, consistent message about the direction and required radical nature of change.

The German approach seeks to provide enough incentives to draw people in, but through repayable loans on favourable terms, or performance-linked investment subsidies, rather than unconditional subsidies or tax concessions, as a more reliable and sustainable funding mechanism.

The German schemes provide qualified expert advice and installation so that appropriate work is carried out to a high standard, resulting in the promised energy gains being achieved and a positive customer experience. One result has been that over time the German construction industry has acquired great expertise in this area. The UK has less experience and expertise, although the years of Warm Front and CERT (and its predecessor supplier programmes) have meant that it is now much better off in this respect than it was. Again, the potential for accreditation mechanisms within the supply chain can support this.

Linking renewable energy generation to energy-saving measures by requiring investments in energy efficiency before subsidies for renewable energy are paid (e.g., through feed-in tariffs) both increases the proportionate contribution renewable energy can make to meeting overall demand, saves the householder money, makes a bigger contribution to the wider goal of climate protection, and provides a more coherent overall message to the public about the need to reduce CO₂ emissions. The UK effectively adopted feed-in tariffs for renewable electricity and heat, but has yet to articulate in legislation a prior requirement to carry out energy efficiency measures to be eligible for these. A trend is being observed in the UK District Heating market that energy efficiency and low carbon heat generation need to be considered in parallel.

It appears better to adopt a 'whole house approach' to energy saving, even if measures are adopted piecemeal, and high energy efficiency measures only implemented bit by bit as people work on different parts of their houses. This enables people to get an overall view of the task ahead and to prioritise and plan for ambitious levels of energy saving. It also makes it easier for energy suppliers and builders to plan for the future, and more likely that ultimately home energy use will decarbonise to the required extent.

New ideas, experimentation and innovation should be developed and trialled through pilots and models, to build awareness and familiarity for new approaches to energy efficiency. This was a significant failing raised by the NAO in its assessment of the Green Deal. Historically, there has been limited activity in the UK and Scotland in terms of building the necessary expertise, institutions and supply chains required to take successful pilots and models to scale.

Ambitious retrofit measures should be applied to public buildings as well as private homes, to provide conspicuous examples to the public. This is particularly the case in schools, nurseries and children's centres, where educational benefits, as well as more general awareness raising, can be secured.

Ultimately there is no getting away from the fact that changing public attitude and behaviour towards energy use, and awareness of the need to reduce greenhouse gas emissions, are going to be required if the necessary step changes in home and non-domestic energy efficiency are to be achieved. In this respect it is hard to avoid the conclusion that the German public is significantly ahead of others across Europe.

5. Conclusion

The present study proposes an evaluation of the implemented EE policies in a selection of EEM members in the EU. After a first part dedicate to the definition of the major differences between supporting actions and regulatory instruments, we proceed to a more qualitative evaluation of these policies through a survey led among 43 lending institutions participating to the EEM initiative. A last part of our evaluation presents more in details two country -specific EE policies implemented in Italy (Superbonus 110%) and Germany (KfW program) and discusses their functioning, but also their strengths and drawbacks.

More precisely, through the differentiation between supporting actions and regulatory policies it is evident that the latter are more widely used in the sample studied, consisting of 17 member states. The same sample is then used to determine how the two subgroups that form the support actions, fiscal and financial policies, are distributed. In this case, we find a substantial distinction, 90% of the policies are financial. Given their predominance, we propose a special focus on them. The results indicate that Germany and Spain are the two countries that have adopted the largest shares of financial policies; moreover, Spain has the most significant number of subcategories among financial policies (Figure 4b).

Concerning the survey to which have participated experts from 43 financial institutions distributed in 17 countries, our aim was to evaluate the general awareness on EE policies among the lending institutions and their preparedness to integrate EE requirements into the locally proposed financial products. The first part of the survey highlights the considerable respondents' general knowledge on buildings' energy efficiency policies. A slight preference for supportive policies over regulatory ones is also evident in the sample and residential and non-residential policies emerge as the preferred sector. Most financial institutions (83%) offer products related to energy efficiency; notably, the exact majority (83%) also include the use of EPCs in their offerings while only one-third offer international energy efficiency related products.

Finally, through two case studies, Superbonus 110% and the KfW programme, it is possible to assess important strengths in energy efficiency policies. As a result of the high number of investments produced in the Italian territory, over 58 billion euros in two years, and the high leverage rate achieved in Germany, at an average of 1:12 in two years, the impact of supportive instruments in energy efficiency policy is evident.

References

- BPIE. (2020). An Action Plan for the Renovation Wave: Collectively achieving sustainable buildings in Europe. https://www.bpie.eu/wp-content/uploads/2020/04/An-action-plan-for-the-renovation-wave_DIGITAL_final.pdf
- Clean energy for all Europeans package. (January 4, 2022). European Commission website. https://energy.ec.europa.eu/topics/energy-strategy/clean-energy-all-europeans-package_en#related-links
- COM 662 final (2020). A Renovation Wave for Europe - greening our buildings, creating jobs, improving https://eur-lex.europa.eu/resource.html?uri=cellar:0638aa1d-0f02-11eb-bc07-01aa75ed71a1.0003.02/DOC_1&format=PDF
- Coma, J., Maldonado JM., de Gracia A., Gimbernat T., Botargues T. & Cabeza LF. (2019). Comparative Analysis of Energy Demand and CO2 Emissions on Different Typologies of Residential Buildings in Europe. *Energies*. <https://doi.org/10.3390/en12122436>
- Directive 2010/31/EU of the European Parliament and of the Council of 19 May 2010 on the energy performance of buildings (recast). (2021). Official Journal of the European Union. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32010L0031>
- Economidou M., Todeschi V., Bertoldi P., D'Agostino D., Zangheri P. & Castellazzi L. (2020). Review of 50 years of EU energy efficiency policies for buildings, *Energy and Buildings*, Volume 225, 2020, 110322, ISSN 0378-7788. <https://doi.org/10.1016/j.enbuild.2020.110322>
- EEA. (2009). Greenhouse gas emission trends and projections in Europe 2009 Tracking progress towards Kyoto targets. <https://www.arp.at.toscana.it/notizie/arp.atnews/2010/allegati/002.pdf>
- EEA. (2022). Greenhouse gas emissions from energy use in buildings in Europe. <https://www.eea.europa.eu/ims/greenhouse-gas-emissions-from-energy>
- European Commission. (2018). Energy performance of buildings directive. https://energy.ec.europa.eu/topics/energy-efficiency/energy-efficient-buildings/energy-performance-buildings-directive_en
- HYPOSTAT (2021). A Review of Europe's Mortgage and Housing Markets. https://eurodw.eu/wp-content/uploads/HYPOSTAT-2021_vdef.pdf
- IEA (2010), Energy Efficiency Governance: Handbook, IEA, Paris <https://www.iea.org/reports/energy-efficiency-governance-handbook>, License: CC BY 4.0. https://iea.blob.core.windows.net/assets/dce331b5-59d1-4f5c-a30a-e7dd7c9b6588/gov_handbook.pdf
- IEA (2022), Accelerating energy efficiency: What governments can do now to deliver energy savings, IEA, Paris <https://www.iea.org/commentaries/accelerating-energy-efficiency-what-governments-can-do-now-to-deliver-energy-savings>
- International Confederation of Energy Regulators. (2010). A Description of Current Regulatory Practices for the Promotion of Energy Efficiency. https://regulationbodyofknowledge.org/wp-content/uploads/2013/04/ICER_A_Description_of.pdf
- Koengkan M., Fuinhas J.A., & Osmani F., Kazemzadeh E., Auza A., Alavijeh A.N. & Teixeira M. (2022). Do financial and fiscal incentive policies increase the energy efficiency ratings in residential properties? A piece

of empirical evidence from Portugal. *Energy*, Volume 241, 122895, ISSN 0360-5442. <https://doi.org/10.1016/j.energy.2021.122895>.

Lee W.L & Yik F.W.H. (2004). Regulatory and voluntary approaches for enhancing building energy efficiency, *Progress in Energy and Combustion Science*, Volume 30, Issue 5. Pages 477-499, ISSN 0360-1285. <https://research.polyu.edu.hk/en/publications/regulatory-and-voluntary-approaches-for-enhancing-building-energy>

Legislative Decree No. 34 May 19, 2020 converted into Law July 17, 2020 No. 77 <https://www.gazzettaufficiale.it/eli/id/2020/05/19/20G00052/sg>

Legislative Decree No. 48 of June 10, 2020 implementing Directive (EU) 2018/844 of the European Parliament and of the Council of May 30, 2018 amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency. (20G00066) <https://www.gazzettaufficiale.it/eli/id/2020/06/10/20G00066/sg>

Neveu, A. & Sherlock, M. (2016). An Evaluation of Tax Credits for Residential Energy Efficiency. *Eastern Econ J* 42, 63–79. <https://doi.org/10.1057/eej.2014.35>

The European Parliament and the Council of the European Union (2010). Directive on the Energy Performance of Buildings (Recast). <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2010:153:0013:0035:en:PDF>

Thonipara A., Runst P., Ochsner C. & Bizer K. (2019). Energy efficiency of residential buildings in the European Union-An exploratory analysis of cross-country consumption patterns. *Energy Pol*, 129, pp. 1156-1167. <https://doi.org/1110.1016/j.enpol.2019.1103.1003>

Timilsina R. G. & Dulal H. B. (2009). Regulatory instruments to control environmental externalities from the transport sector. (2009). The World Bank 1818 H Street, NW, Washington, DC 20433, USA. <https://core.ac.uk/download/pdf/41174701.pdf>

Trotta G., Spangenberg, J. & Lorek, S. Energy efficiency in the residential sector: identification of promising policy instruments and private initiatives among selected European countries. *Energy Efficiency* 11, 2111–2135 (2018). <https://doi.org/10.1007/s12053-018-9739-0>

Updating the Energy Performance of Buildings Directive. (17 January 2022). Interreg Europe. <https://www.interregeurope.eu/news-and-events/news/updating-the-energy-performance-of-buildings-directive>

Villca-Pozo M. & Gonzales-Bustos J.P. (2019). Tax incentives to modernise the energy efficiency of the housing in Spain *Energy Pol*, 128. pp. 530-538. <https://doi.org/510.1016/j.enpol.2019.100>